CLAIMS

What is claimed is:

1. A method of processing first and second images acquired by a digital radiography imaging system at different energy levels and different times, comprising the acts of:

decomposing soft tissue and bone images from the first and second images; and

mitigating noise amplification at attenuated regions of at least one of the first and second images during decomposition.

2. The method of claim 1, comprising the act of acquiring the first and second images at low and high energy levels, respectively.

3. The method of claim 2, wherein the act of acquiring the first and second images comprises the act of acquiring the first and second images at first and second times over a time interval less than one second.

4. The method of claim 2, wherein the act of acquiring the first and second images is performed using flat-panel detector technology of the digital radiography imaging system.

5. The method of claim 1, wherein the act of decomposing soft tissue and bone images is performed pixel-by-pixel by computing an image intensity ratio of the second image to the first image, the first and second images corresponding to low and high energy levels of the digital radiography imaging system, respectively.

6. The method of claim 5, wherein the act of mitigating noise amplification at attenuated regions comprises the act of modifying the image intensity ratio to reduce noise associated with the act of decomposing soft tissue and bone images.

7. The method of claim 6, wherein the act of modifying the image intensity ratio to reduce noise comprises the act of weighting the first image with a noise stabilizing parameter.

8. The method of claim 7, wherein the act of weighting the first image with the noise stabilizing parameter comprises the act of increasing image intensity of the first image at the attenuated regions.

9. The method of claim 5, comprising the act of contrast-matching noise-mitigated image data associated with one of the soft tissue and bone images with image data associated with at least one of the first image, the second image, the soft tissue image, and the bone image.

10. The method of claim 9, wherein the act of contrast-matching comprises the act of contrast-matching noise-mitigated image data associated with the soft tissue image with the second image.

11. The method of claim 9, wherein the act of contrast-matching comprises the act of contrast-matching noise-mitigated image data associated with the bone image with contrast-artifacts-mitigated image data associated with the bone image.

12. The method of claim 5, comprising the act of smoothing image data associated with one of the soft tissue and bone images using a low pass filter to average over neighborhoods of the image data.

13. The method of claim 5, wherein the act of decomposing soft tissue and bone images comprises the act of computing noise-mitigated image data (I1) associated with one image of the soft tissue and bone images based on an equation: $I1 = IH*IL^{WF}/[(IL^{WF})^2 + \Psi]$, where IL is an image intensity of the first image, IH is an image intensity of the second image, WF is a decomposition factor for the one image, and Ψ is the noise stabilizing parameter for the one image.

14. The method of claim 13, wherein the act of computing the noise-mitigated image data I1 comprises the act of selecting the noise stabilizing parameter Ψ in a range of 1 to 5.

15. The method of claim 13, wherein the act of decomposing soft tissue and bone images comprises the act of computing contrast-stabilized image data (IS2) associated with the soft tissue image pixel-by-pixel based on an equation: $IS2 = I1^{[WB/(WB - WS)]}$, where WB is a decomposition factor for the bone image, and WS is a decomposition factor for the soft tissue image, and the one image is the soft tissue image.

16. The method of claim 15, wherein the act of decomposing soft tissue and bone images comprises the act of mitigating pixel intensity abnormalities associated with the soft tissue image pixel-by-pixel based on an equation: $IS3 = IH/(IS2 + \Phi_1)$, where IH is the image intensity of the second image and Φ_1 is an intensity correction factor.

17. The method of claim 16, wherein the act of decomposing soft tissue and bone images comprises the act generating smoothed image data (IS4) associated with the soft tissue image using a low pass filter to average over neighborhoods of the enhanced image data IS3.

18. The method of claim 17, wherein the act of decomposing soft tissue and bone images comprises the act generating the soft tissue image pixel-by-pixel based on an equation: IS = IS2 * IS4.

19. The method of claim 13, wherein the act of decomposing soft tissue and bone images comprises the act of computing contrast-stabilized image data (IB2) associated with the bone image pixel-by-pixel based on an equation: $IB2 = IH*IL^{WB}/[(IL^{WB})^2 + 1.0]$, where IL is an image intensity of the first image, IH is the image intensity of the second image, and WB is a decomposition factor for the bone image.

20. The method of claim 19, wherein the act of decomposing soft tissue and bone images comprises the act of mitigating pixel intensity abnormalities associated with the bone image pixel-by-pixel based on an equation: $IB3 = IB2/(I1 + \Phi_2)$, where Φ_2 is an intensity correction factor, and the one image is the bone image.

21. The method of claim 20, wherein the act of decomposing soft tissue and bone images comprises the act generating smoothed image data (IB4) associated with the bone image using a low pass filter to average over neighborhoods of the enhanced image data IB3.

22. The method of claim 21, wherein the act of decomposing soft tissue and bone images comprises the act of contrast-matching noise-mitigated image data I1 with smoothed image data IB4 by computing contrast-matched image data (IB5) associated with the bone image pixel-by-pixel based on an equation: IB5 = I1 * IB4.

23. The method of claim 22, wherein the act of decomposing soft tissue and bone images comprises the act of normalizing intensity levels of the contrast matched image data IB5 to generate the bone image.

24. A method of producing soft tissue and bone images of the desired anatomy of a patient, comprising the acts of:

acquiring first and second images of the desired anatomy from a digital radiography imaging system at low and high-energy levels at first and second times, respectively;

decomposing soft tissue and bone images of the desired anatomy from the first and second images pixel-by-pixel using an image intensity ratio of the second image to the first image; and

mitigating noise amplification at attenuated regions of at least one of the first and second images by weighting intensity of the first image with a noise stabilizing parameter during decomposition.

25. The method of claim 24, wherein the act of weighting the first image with the noise stabilizing parameter comprises the act of increasing image intensity of the first image at the attenuated regions.

26. The method of claim 24, comprising the act of contrast-matching noise-mitigated image data associated with one of the soft tissue and bone images with image data associated with at least one of the first image, the second image, the soft tissue image, and the bone image.

27. The method of claim 26, wherein the act of contrast-matching comprises the act of contrast-matching noise-mitigated image data associated with the soft tissue image with the second image.

28. The method of claim 26, wherein the act of contrast-matching comprises the act of contrast-matching noise-mitigated image data associated with the bone image with contrast-artifacts-mitigated image data associated with the bone image.

29. The method of claim 24, comprising the act of smoothing image data associated with one of the soft tissue and bone images using a low pass filter to average over neighborhoods of the image data.

30. The method of claim 29, wherein the act of smoothing image data comprises the act of filtering the image data using a boxcar filter as the low pass filter.

31. The method of claim 24, wherein the act of acquiring the first and second images of the desired anatomy comprises the act of imaging chest anatomy over a time interval.

32. A computer program for processing image data acquired from a digital radiography imaging system, comprising:

a tangible medium configured to support machine-readable code; and

machine-readable code supported on the medium and comprising a modified dual-energy decomposition routine for decomposing soft tissue and bone images from first and second images obtained from the digital radiography imaging system at different energy levels and different times, the modified dual-energy decomposition routine comprising:

a noise mitigation routine adapted to reduce noise amplification at attenuated regions of at least one image of the first and second images by weighting intensity of the first image with a noise stabilizing parameter during decomposition.

33. The computer program of claim 32, wherein the noise mitigation routine comprises an intensity enhancement routine adapted to increase image intensity of the first image at the attenuated regions.

34. The computer program of claim 32, comprising a contrast stabilizing routine adapted to stabilize image contrast during decomposition, wherein the contrast stabilizing routine comprises a contrast-matching routine adapted to match contrast of one of the soft tissue and bone images with image data associated with at least one of the first image, the second image, the soft tissue image, and the bone image.

35. The computer program of claim 34, wherein the contrast-matching routine comprises a soft-tissue contrast-matching routine adapted to match contrast of noise-mitigated image data of the soft tissue image with the second image.

36. The computer program of claim 34, wherein the contrast-matching routine comprises a bone contrast-matching routine adapted to match contrast of noise-mitigated image data of the bone image with contrast-artifacts-mitigated image data of the bone image.

37. The computer program of claim 32, comprising a contrast stabilizing routine adapted to stabilize image contrast during decomposition, wherein contrast stabilizing routine comprises an image smoothing routine adapted to smooth image data associated with one of the soft tissue and bone images using a low pass filter to average over neighborhoods of the image data.

38. A medical imaging system, comprising:

a digital radiographic imaging system, comprising:

an x-ray device adapted to generate x-rays;

a collimator adapted to filter the x-rays in a desired anatomical region of a patient;

a flat-panel digital x-ray detector adapted to detect x-rays passing through the patient; and

dual-energy control circuitry adapted to acquire first and second images of the desired anatomical region at different energy levels over a time interval; and

an image processing system, comprising:

a modified dual-energy image decomposition module adapted to mitigate noise amplification and contrast variations associated with decomposing soft tissue and bone images from the first and second images, comprising:

a noise mitigation module adapted to reduce noise amplification at attenuated regions of at least one image of the first and second images by weighting intensity of the first image with a noise stabilizing parameter during decomposition.

39. The system of claim 38, comprising a contrast-matching module operational during decomposition, wherein the contrast-matching module is adapted to match contrast of one of the soft tissue and bone images with image data associated with at least one of the first image, the second image, the soft tissue image, and the bone image.

40. The system of claim 39, wherein the contrast-matching module comprises a soft-tissue contrast-matching module adapted to match contrast of noise-mitigated image data of the soft tissue image with the second image.

41. The system of claim 39, wherein the contrast-matching module comprises a bone contrast-matching module adapted to match contrast of noise-mitigated image data of the bone image with contrast-artifacts-mitigated image data of the bone image.

42. The system of claim 38, comprising an image smoothing module operational during decomposition, wherein the image smoothing module is adapted to smooth image data associated with one of the soft tissue and bone images using a low pass filter to average over neighborhoods of the image data.

43. A system for decomposing soft tissue and bone images from first and second energy images acquired by a digital radiography imaging system over a time interval, comprising:

means for mitigating noise while decomposing the first and second energy images into at least one image of the soft tissue and bone images.

44. The system of claim 43, comprising means for stabilizing contrast while decomposing the first and second energy images into the at least one image.

45. The system of claim 43, comprising means for acquiring the first and second energy images from the digital radiography imaging system.